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PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in or relating to Centrifugal Compressors.

We, SIEMENS-SCHUCKERTWERKE AKTIEN-  
GESELLSCHAFT, a German Company, of  
Berlin-Siemensstadt, Germany, do hereby  
declare the nature of this invention and  
5 in what manner the same is to be per-  
formed, to be particularly described and  
ascertained in and by the following state-  
ment :—

In the regulation of centrifugal com-  
10 pressors as is well known very material  
difficulties are encountered when the  
quantity to be fed forward approached  
the so called pump limit that is to say  
that condition in which a reversal of the  
15 direction of flow takes place in the com-  
pressor. Endeavours must be made to  
keep this pump limit as low as possible so  
as to enable the compressor to be used  
within a very wide area of regulation.  
20 With the regulation of the speed alone a  
displacement of the pump limit can not be  
brought to pass, as, on the contrary addi-  
tional regulating members will have to be  
used. According to the present invention  
25 these additional regulating members are  
formed by a change over apparatus by  
means of which one or more suction stages  
are switched off or disconnected and, at  
the same time a corresponding number of  
30 pressure stages can be placed in connec-  
tion. This enables the working area of  
the compressor to be displaced towards  
the pressure side where the cross section  
per se becomes smaller. For the smaller  
35 output, consequently, a part of the com-  
pressor is utilised which owing to its  
dimensions is adapted to this quantity.

It is no longer new per se to equip a  
40 centrifugal compressor with suction and  
pressure stages which can be disconnected  
to enable it to be adapted to changing  
quantities of supply. However, in the  
proposals hitherto made quite a different  
45 method had been adopted. When the  
quantity supplied fell off the first suction  
member and the last pressure member were  
first disconnected. Upon a further  
reduction the second suction member and  
50 the penultimate pressure member were  
disconnected and so on. The delivery or  
supply area of the compressor was, there-  
fore, to a certain extent displaced towards  
the centre, that is to say in an area in

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which the compressor was bound always to  
work in a more unfavourable manner. 55  
The reason is because the smaller the  
quantity supplied becomes then, relatively  
speaking, the greater will the supply  
cross sections become upon the pressure  
side, that is to say all the more unfavour-  
able does the method of operation of the  
compressor become. In contradistinction  
to this according to the invention the  
supply range of the compressor is dis-  
placed towards the main pressure side  
that is to say towards those supply cross  
sections which, owing to their dimensions,  
are especially adapted to the reduced  
quantity supplied.

A working example of the invention is  
shown in the accompanying drawings with  
three disconnectable suction stages and  
three disconnectable pressure stages.  
The suction stages and pressure stages  
are indicated at 1—3 and 4—6 re-  
spectively. The air first flows into  
70 the common influx vessel 7 and, after  
compression, passes into the accumulator  
8. In the suction stages there are the  
clack valves 11—13 and in the pressure  
stages there are inserted the clack valves  
14 to 16. Th pivots of the clack valves  
carry, outside of the condenser, levers  
21—26 the levers 21—23 appertaining to  
the clack valves on the suction side and  
the levers 24—26 to the valves on the  
pressure side. These levers co-operate  
with adjustment rods, the levers 21 and 23  
with the rod 9 and the levers 24—26 with  
the rod 10. For the displacement of the  
levers 9 and 10 use is made of a lever  
19 which is coupled to them through the  
rod 18. For the displacement of the indi-  
vidual valves the rods 9 and 10 are pro-  
vided with stops 31 to 36. The lever 21  
and the stop 31 and also lever 24 and stop  
34 are in engagement with each other  
through the springs 41 and 44.

The regulating process pursues the  
following course :—

First with the speed regulator of the  
driving prime mover its regulating range  
or area is controlled out. In this case the  
valves 11 and 14 are opened whilst the  
remaining valves remain closed. Hence 105  
the first three suction stages are in opera-

tion whilst the two last pressure stages are disconnected. The stops 33 and 36 do not bear against the levers 23 and 26. If after regulating out the machine further controlling ensues the lever 18 is swung out in a clockwise direction by means of the rod 19 so that the rod 10 is displaced to the right and the rod 9 to the left. The valves 11, 12, 14 and 15 upon this movement first pass into the position shown in the drawing. The first suction stage and the ante-penultimate pressure stage are disconnected. Likewise the third suction stage and the last pressure stage are also disconnected. Should this regulation still be insufficient to adapt the output of the compressor to the reduced consumption then the rod 19 is moved still further and the valves 12 and 15 are also closed whilst at the same time the valves 13 and 16 are opened. The ante-penultimate stage of the compressor now becomes the suction stage and all the other stages of the compressor participate in the supply. The valves 11 and 14 remain in the position which they had already taken up because the further movement of the rods 9 and 10 only leads to a compression of the loading spring. If the air consumption again increases then the adjusting process of the individual throttle valves takes place in the opposite direction.

By the new arrangement on the one hand the pumping limit is very considerably reduced and, on the other hand, the

final pressure is maintained constant which as is well known is primarily dependent upon the number of stages of a compressor.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An arrangement for reducing the pump limit of centrifugal compressors the cross sections of flow of which become smaller in size towards the pressure side and in which several suction stages and several pressure stages are connected to collecting chambers and in the union pipes change-over members such as check valves or the like are provided, characterised by the fact that one or more suction stages are adapted to be disconnected whilst at the same time a corresponding number of pressure stages can be so connected that the working range of the compressor is displaced towards the pressure side.

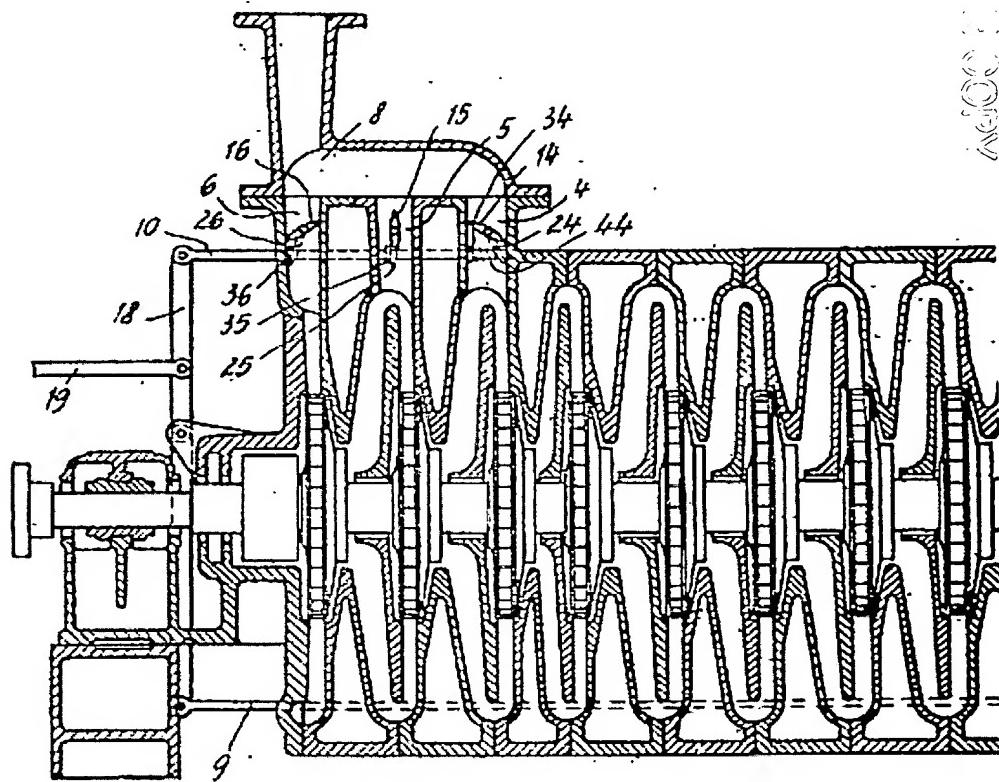
2. A centrifugal compressor constructed and adapted to operate substantially as hereinbefore described with reference to the accompanying drawing.

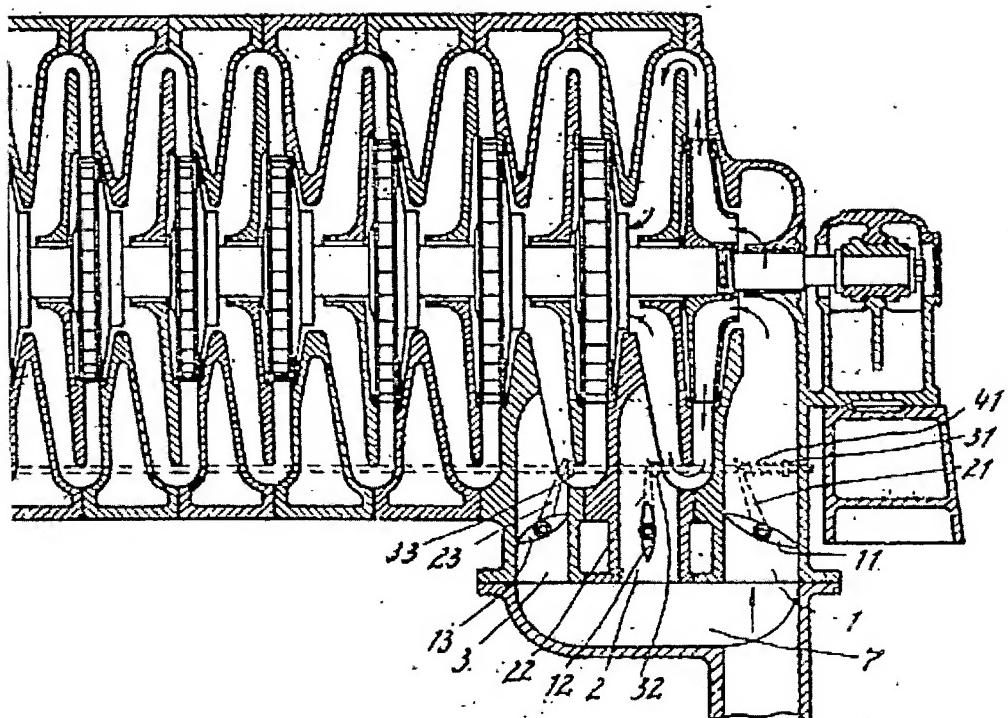
Dated this 6th day of June, 1930.

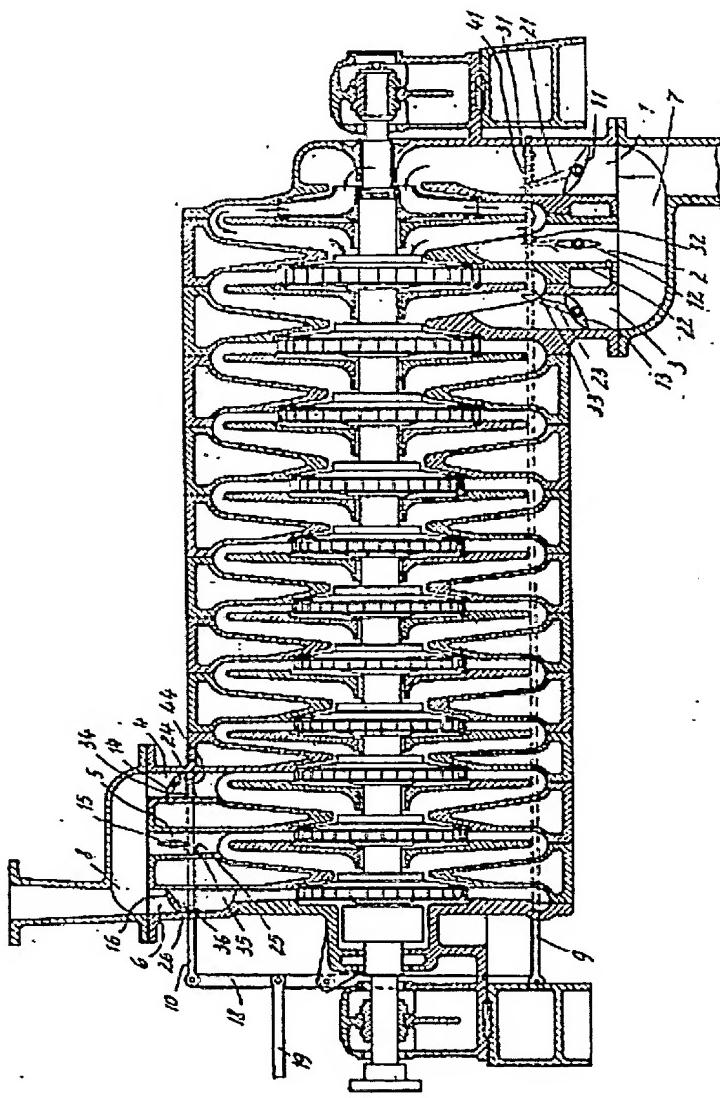
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[This Drawing is a full-size reproduction of the Original.]







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